Space Weather Technical Forecast

Issued on Monday, 17 October 2022 at 01:08 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with X-ray flux at GOES16 near the boundary of B and C-class, with a few small flares evident. The largest of these was a C1.9 at 16/1606UTC from sunspot region AR3123, which took the form a of a proliferating Cro/Beta. This was one of four sunspot regions on the disc, with the other main group being AR3124 in the southwestern quadrant, which saw marked areal growth and some spreading to become a Dao/Beta by the period's end. Making up the current front side were two other Bxo/Beta regions, which were largely unchanged in the 24 hours.

There remain numerous filaments on the facing side of the Sun at present, and while some of these were mobile in the period, none obviously lifted off, and no Coronal Mass Ejections (CMEs) were in evidence on available satellite imagery at the time of writing.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by ACE and DSCOVR at L1, showed ongoing connection to the fast wind of CH32, with the phi angle accordingly mostly negative (away from the Sun), but with a period of positive observed between 16/0530 and 16/1130UTC.

The solar wind speed showed a roughly level tendency in the upper 500s of km/s, with an average of around 575. The solar wind density was level near 10ppcc, while the IMF showed a similar flat trend with a peak of 6nT and a north-south component between +/-6. The net result of these solar wind measures was provisionally Quiet to Active, with a peak of Kp 4+ in the 09-12UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, has remained at Background levels.

High energy electron flux at GOES16 (greater than 2MeV) rose from Normal Background to Moderate levels, with a peak flux of 809pfu recorded at 16/1735UTC. The associated fluence was below the Active (1e8 integrated pfu) threshold, but with a rising trend, with the 17/0001UTC observation being 1.6e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low or Very Low, barring any significant sunspot development on the visible disc.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs, and the only fast wind expected in the period (from CH32/-) is already in course.

An initial Slight Chance of Active intervals should fall to become reliably Quiet from midweek

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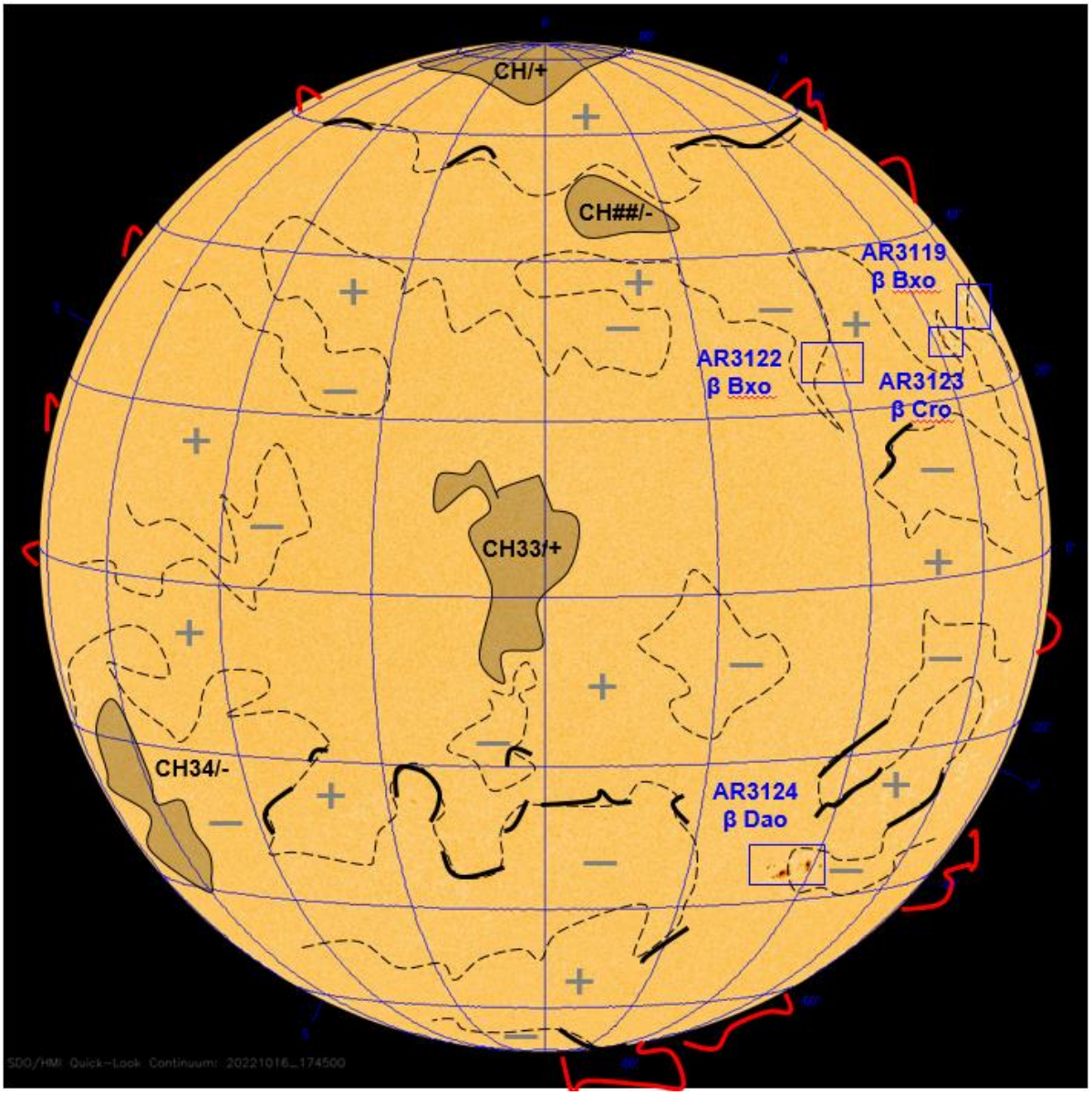
UTC as Earth exits a fast wind for a slow regime.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at Background levels.

High energy electron flux (greater than 2MeV) are likely to rise further early in the coming UTC working week, perhaps reaching High at diurnal peak, although this is low confidence. The associated 24-hour fluence is expected to rise, perhaps most likely saturating a little below the Active (1e8 integrated pfu) threshold before midweek UTC in response to the incumbent CH32/- fast wind.

Figure 1. Solar Analysis Valid 16/1745UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs in the current forecast.

For the purposes of identifying possible upcoming minor characteristics in the solar wind, a filament CME from 13 October may perform a close pass below the ecliptic early on day one (Monday 17 October). Similarly, another filament from 14/2200UTC may deliver a weak glance between the UTC days of 17 and 18 October, although again, no significant impacts are anticipated.

The only coronal hole fast wind to feature in the four days is the incumbent CH32/-, which is now mature. This feature ought to decay to leave a slow regime at Earth by midweek UTC, with a Slight Chance of initial Active intervals falling to become reliably Quiet from day three, Wednesday 19 October.

A second coronal hole, CH33 which is currently straddling the solar meridian appears smaller and more tenuous than on last pass, possibly also with a slightly retrogressed position on the disc, such that it is not expected to arrive in the forecast period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
13/1610	Partial	Filament eruption	S-centre	408km/s	Missing	Chance of peripheral influence late 16th or early 17th
15/0600	Partial	Filament eruption	SW	520km/s	Missing	Low Chance of peripheral influence late 17th or early 18th

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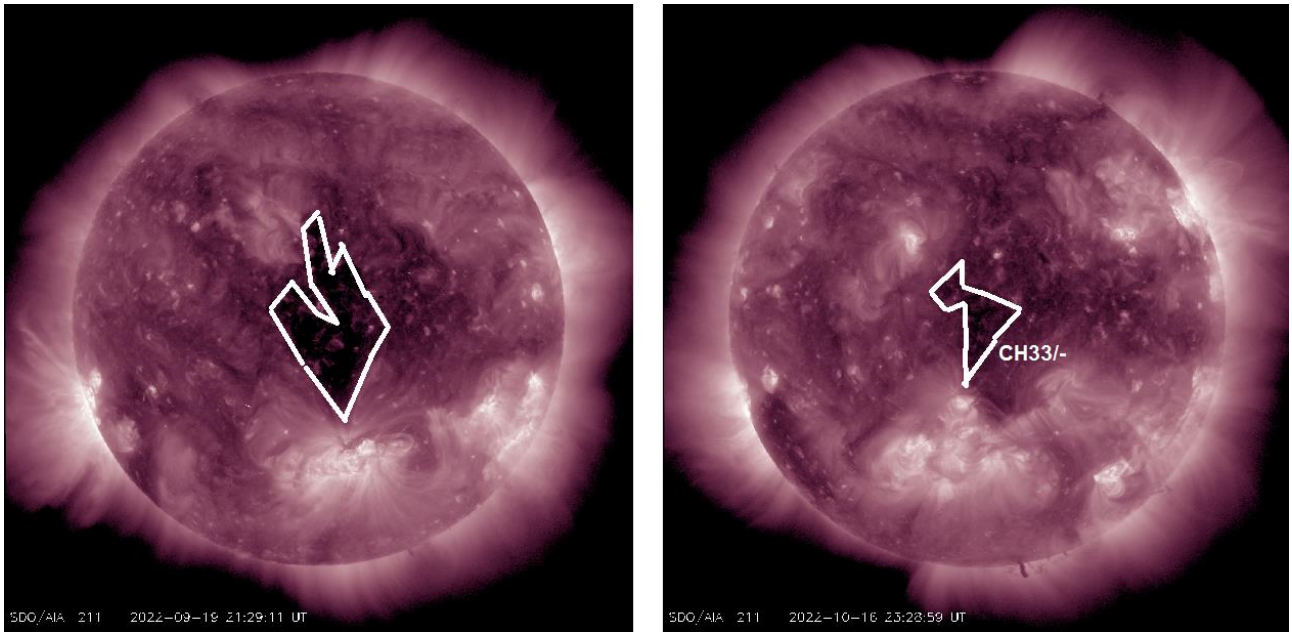
Figure 2: AIA211 from the previous rotation and current, showing the diminished size of forthcoming CH33, as well as a slight retrogression on the disc.



Radio Blackouts - X-Ray Flares:

Solar activity over the past 24 hours has been Low. There are currently four numbered regions on the visible disc, with all of these presenting as relatively straightforward magnetically bipolar regions. The most marked growth in the past 24 hours was observed in AR3124 in the southwestern quadrant, however this was not capped by any noteworthy flares, and the trend appears to have stalled having reached a Dao/Beta group. The only other noteworthy changes were proliferation of spots in AR3123 in the northwest, although this only resulted in low-level C-class flaring.

The balance of numbers of sunspot groups on the front side may decrease in the period, with AR3119 and AR3123 leaving before midweek UTC, and with the remaining two regions lying on the limb by the end of the four days. Far-side soundings, flux looping on AIA171 (for example) and STEREO A EUVI 195 imagery all hint at a possible returning sunspot region over the southeastern solar horizon, perhaps Ex-3107. The extent to which this survives remains to be seen however, and the trend in flare risk is therefore downwards.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

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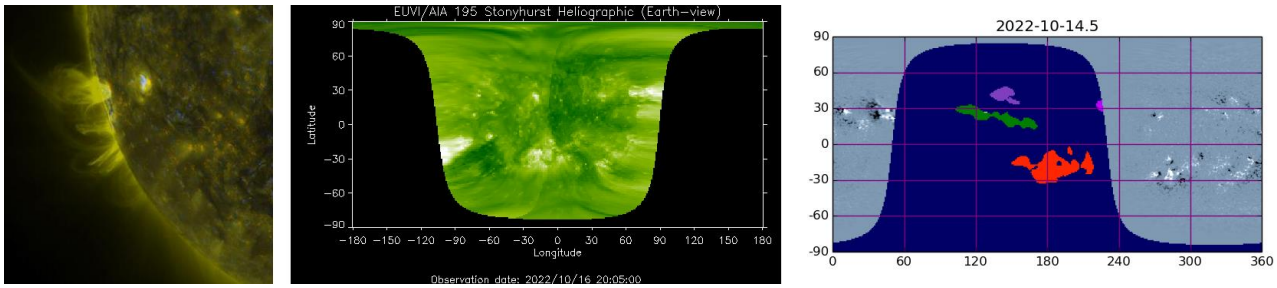
Figure 3: Left to right: AIA171 and HMIBC composite image from 16/2200UTC, showing the current southeastern limb; STEREO A EUVI 195 showing an extended bright flux region in this area; and far side sounding from two days prior, showing a large feature in this approximate position.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at Background levels and is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES16 saw an increase in its diurnal oscillation in the past 24 hours, such that the chances of breaching Active 24-hour integrated fluence are now increased. The latest MOSWOC REFM has moved towards this idea, with 72-hour fluence now predicted to be narrowly short of 1e8 integrated pfu.

It is considered quite likely that the magnitude of the diurnal oscillation in flux should increase again over the coming 24 hours, with the current fast wind from CH32 now mature and geomagnetic activity beginning to become more reliably Quiet to Unsettled - as opposed to Active. The chances of Active fluence therefore increase early in the coming working week, saturating by midweek but probably slightly below the requisite Active threshold. This forecast carries low confidence, as the current fast wind from CH32 is of greater magnitude compared to last pass.

CH32 is expected to be the only feature impinging on the forecast in the period, with CH33 too distant and with all observed CMEs likely to miss Earth.

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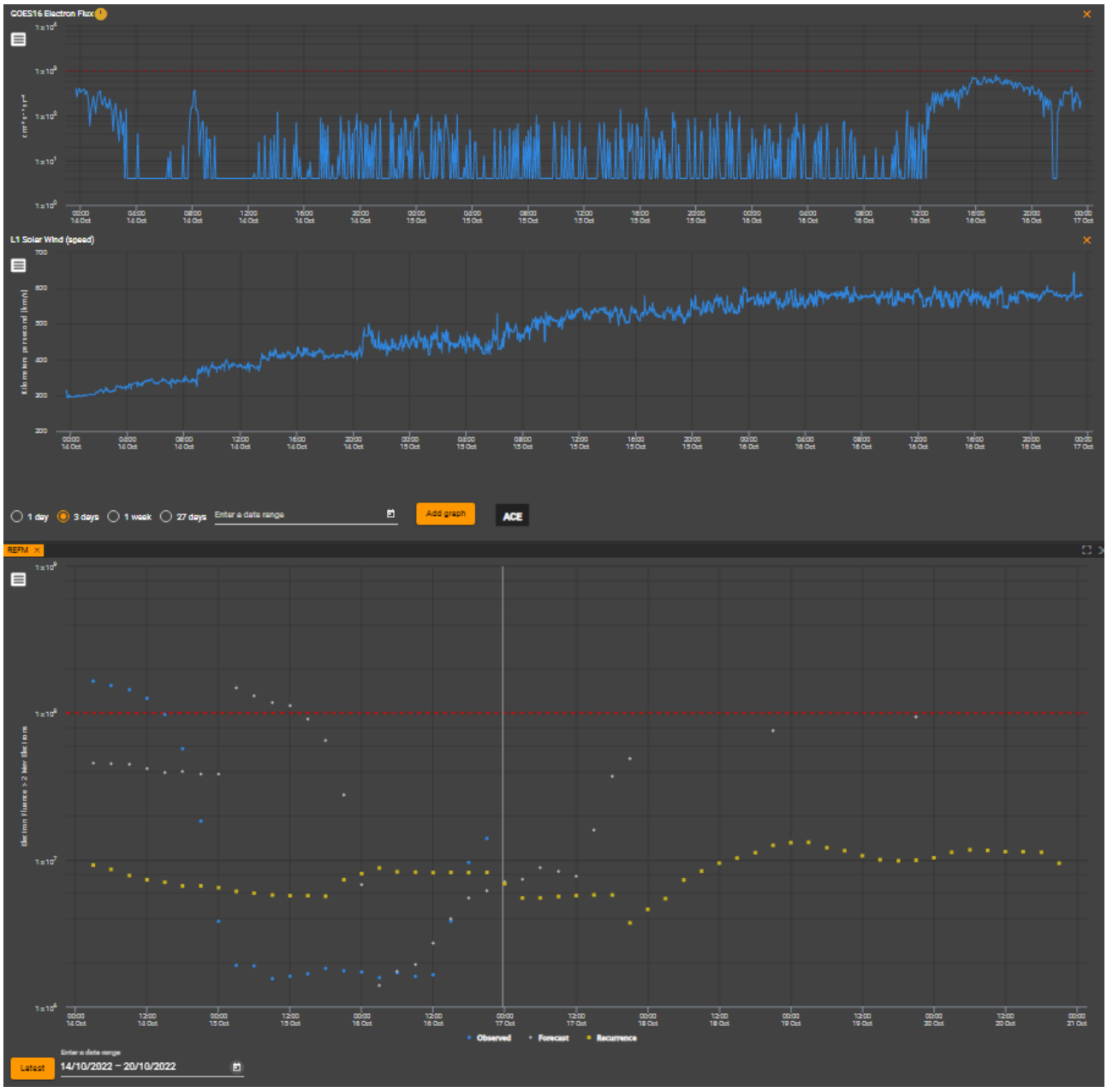
GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	40	40	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Past three days in GOES16 high energy electron flux (top, greater than 2MeV); L1 solar wind speed as measured by DSCOVR, with current fast wind from CH32 shown; and past three days in 24-hour fluence observations (blue dots) as well as REFM forecast (white) and 27-day peristence (yellow).



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